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AGRICULTURAL MEMORANDUM NO 930

THE EFFECT OF POLYTHENE MULCHES ON SOIL TEMPERATURES IN AN OVERWINTERED CARROT CROP

Correction

Page 2 paragraph beginning - Differences in accumulated temperature ..... etc should read: Differences in accumulated temperature above 0°C are small for both treatments - 2% reduction for black and 11% for white polythene. However differences for a base of 6°C are larger at 17% and 33% respectively.

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The effect of polythene mulches on soil temperatures in an overwintered carrot crop

by

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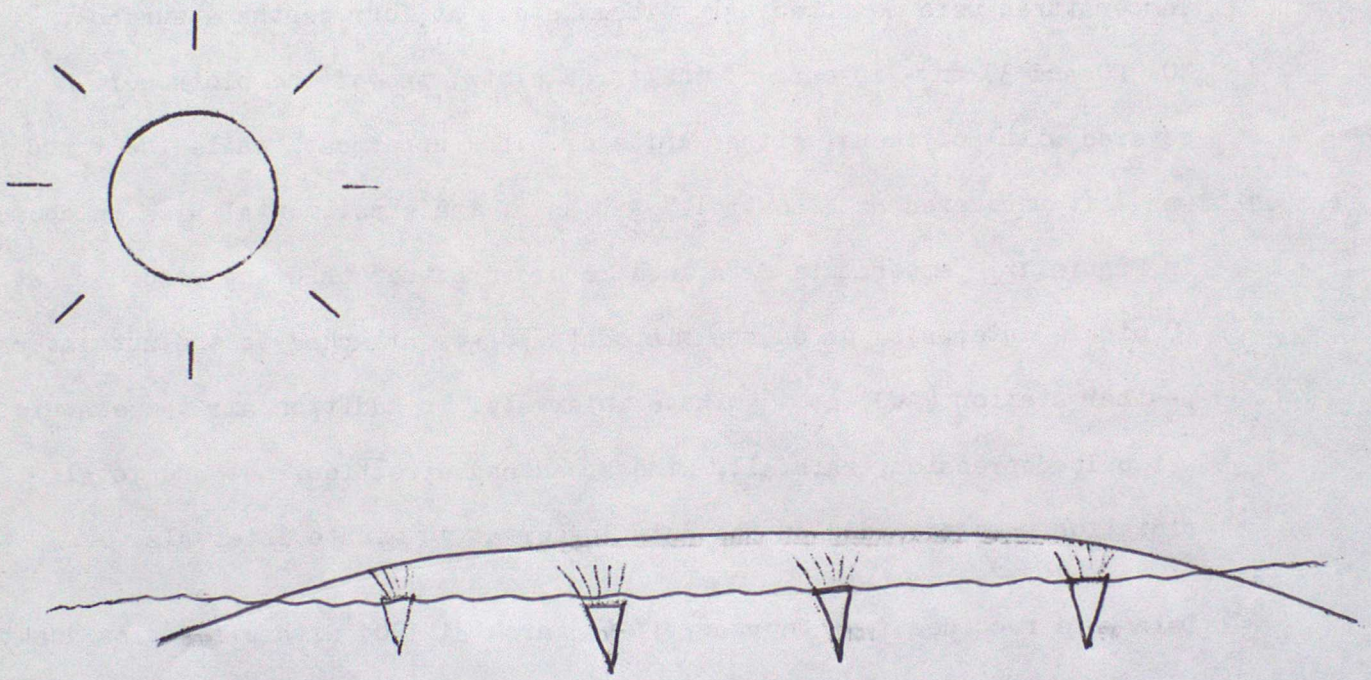

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October 1981

Introduction

Carrots, overwintered in the soil, start to make top growth as the soil warms up in spring and their quality deteriorates. It may be possible to slow the soil warming process by covering the carrots with opaque plastic sheeting and thereby extend the marketable period of good quality carrots.

The results of a limited preliminary study carried out at Arthur Rickwood EHF in spring 1981 are presented here.

Instrumentation

Temperatures were measured using thermistors at four depths - surface, 10, 20 and 30 cm - in each of the three plots; two of the plots were covered with polythene, either white or black uppermost, while the third was left uncovered as a control. A plan of the experimental area is shown in Figure 1. Temperature data were recorded either on Grant recorder (at 60 minute intervals) or on the Microdata logger attached to the automatic weather station (AWS) at 15 minute intervals. In addition air temperature wet bulb depression, rainfall, wind speed and direction, net and total radiation were recorded on the data logger at 15 minute intervals.

Data were recorded from February 17 to March 31 1981 with a few gaps due to instrument and human failure.

Results

Data were tabulated at hourly intervals; the thermistor resistance measurements as recorded by the logger being converted to temperatures. Because of the volume of data and the necessity of hand processing, three hourly data (00, 03, 06 ..... etc) were used for computing temperature differences between control and covered plots. The results are set out in Table 1. The results under white polythene are also represented graphically in Figure 2.

As perhaps might have been expected the results show that average soil temperatures recorded under the plot covered with white polythene were significantly lower than those under the black polythene, while both were, on average, colder than control even at 30 cm.

Degree days above $0^{\circ}C$ and $6^{\circ}C$ were computed for 10 cm depth as it is probably the degree days above a threshold value which is responsible for the rate of growth and deterioration of the carrot. The results are shown in the table below. The 10 cm depth was chosen as it is about half the depth of the carrot and so probably the most appropriate.

	Degree days above $0^{\circ}C$	% of Control	Degree days above $6^{\circ}C$	% of control
White	205	89	41	67
Black	226	98	52	83
Control	230	100	62	100

The carrots under the polythene were examined after the experiment to see if there had been any detrimental effects due to the polythene - ie more diseased carrots due to perhaps increased humidity under the polythene, but no pronounced difference in carrot quality was found.

Differences in accumulated temperature above $0^{\circ}C$ are small for both treatments - 2% reduction for ~~white~~ black and 11% for ~~black~~ white polythene. However differences for a base of $6^{\circ}C$ are larger at 17% and 33% respectively.

Discussion

So far data have been recorded in only one brief, unreplicated experiment and it would be foolhardy to suggest any general conclusions. The time of covering the carrots must be important - since covering after a comparatively warm spell would tend to maintain the soil temperatures under

the mulch in any ensuing cold spell. Ideally it would seem best to apply the mulch (probably white) during a cold spell in early spring while soil temperatures are still below the growth threshold for the carrots.

Covered plots in this study were just over 1 metre square and it would be desirable to repeat the trial using larger plots to eliminate edge effects of both temperature and rainfall.

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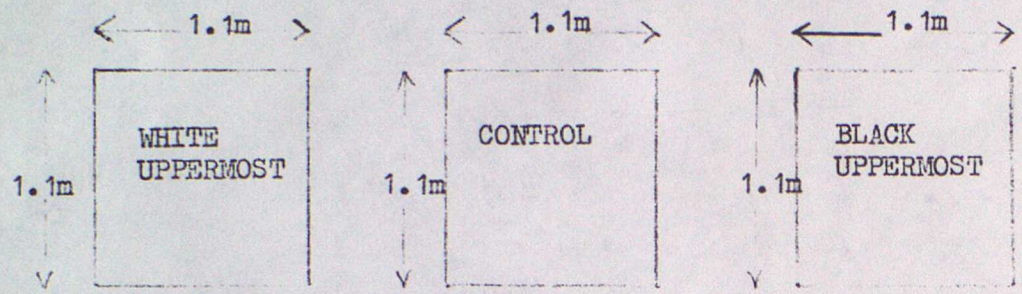
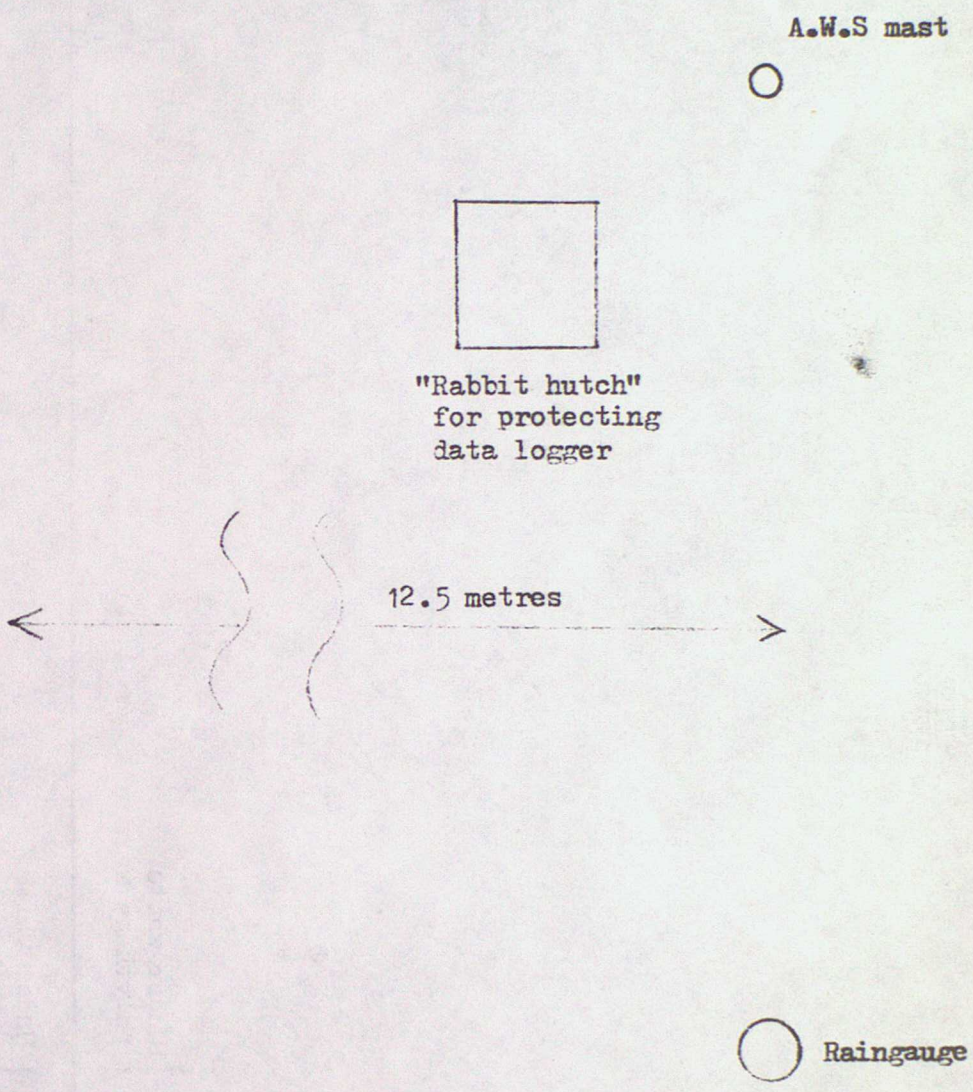
Any comments or suggestions on this paper should be referred to the author.

FIGURE 1





Scale 1" = 1 metre

FIGURE 2

WHITE - CONTROL

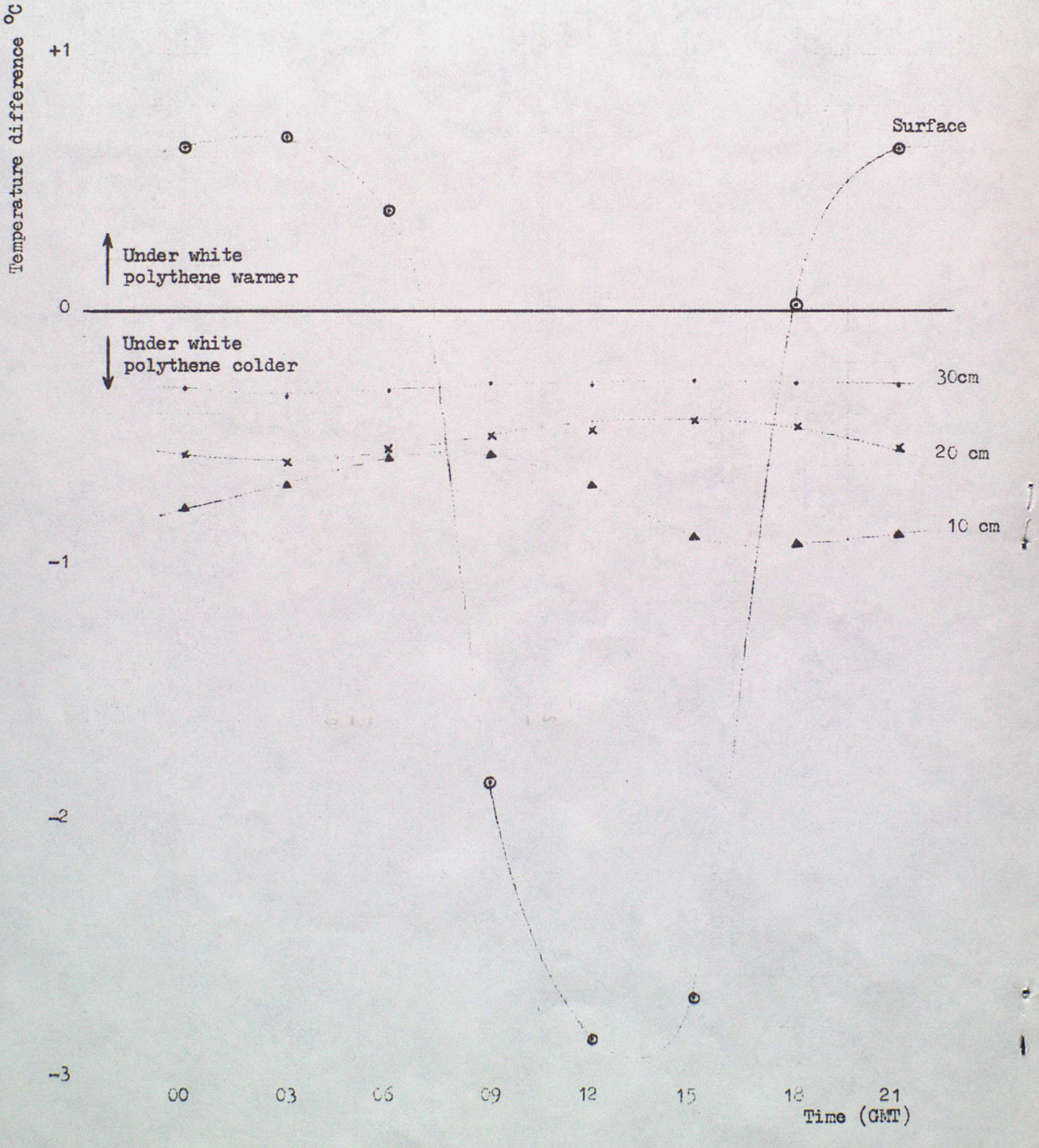


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TABLE 1

AVERAGE TEMPERATURE DIFFERENCES BETWEEN POLYTHENE COVERED PLOTS AND CONTROL AT THREE HOURLY INTERVALS

SURFACE

WHITE - CONTROL

TIME (GMT)	00	03	06	09	12	15	18	21
AVERAGE (°C)	0.65*	0.68*	0.39	-1.84*	-2.85*	-2.69*	0.02	0.63
S.D. (°C)	1.87	1.89	1.47	2.33	3.07	2.59	1.76	2.06

OVERALL AVERAGE = - 0.72°C

BLACK - CONTROL

TIME (GMT)	00	03	06	09	12	15	18	21
AVERAGE (°C)	0.48	0.65	0.30	-1.11*	-1.58*	-1.66*	0.09	0.59
S.D. (°C)	1.57	1.78	1.43	1.85	1.99	1.77	1.35	1.80

OVERALL AVERAGE = - 0.18°C

10 cm

WHITE CONTROL

TIME (GMT)	00	03	06	09	12	15	18	21
AVERAGE (°C)	-0.77*	-0.68*	-0.58*	-0.56*	-0.68*	-0.88*	-0.91*	-0.87*
S.D. (°C)	0.51	0.50	0.49	0.47	0.53	0.57	0.56	0.53

OVERALL AVERAGE = - 0.74°C

BLACK - CONTROL

TIME (GMT)	00	03	06	09	12	15	18	21
AVERAGE (°C)	-0.06	0.05	0.13	0.14	-0.13	-0.43*	-0.41*	-0.25*
S.D. (°C)	0.90	0.86	0.88	0.88	0.88	0.93	0.90	0.90

OVERALL AVERAGE = - 0.11°C

* SIGNIFICANTLY DIFFERENT FROM ZERO AT THE 95% PROBABILITY LEVEL

TABLE 2

AVERAGE TEMPERATURE DIFFERENCES BETWEEN POLYTHENE COVERED PLOTS AND CONTROL AT THREE HOUR LY INTERVALS

20 cm

WHITE - CONTROL

TIME (GMT)	00	03	06	09	12	15	18	21
AVERAGE (°C)	-0.56*	-0.59*	-0.54*	-0.49*	-0.46*	-0.42*	-0.44*	-0.53*
S.D. (°C)	0.36	0.38	0.39	0.45	0.42	0.40	0.49	0.38

OVERALL AVERAGE = - 0.51°C

BLACK - CONTROL

TIME (GMT)	00	03	06	09	12	15	18	21
AVERAGE (°C)	-0.35*	-0.33*	-0.27*	-0.26*	-0.20	-0.16	-0.19	-0.30*
S.D. (°C)	0.47	0.50	0.53	0.56	0.57	0.51	0.59	0.49

OVERALL AVERAGE = - 0.26°C

30 cm

WHITE - CONTROL

TIME (GMT)	00	03	06	09	12	15	18	21
AVERAGE (°C)	-0.30*	-0.33*	-0.31*	-0.28*	-0.29*	-0.27*	-0.28*	-0.29*
S.D. (°C)	0.23	0.24	0.22	0.23	0.24	0.22	0.22	0.24

OVERALL AVERAGE = - 0.29°C

BLACK - CONTROL

TIME (GMT)	00	03	06	09	12	15	16	21
AVERAGE (°C)	-0.13*	-0.11	-0.11	-0.08	-0.09	-0.07	-0.09	-0.11*
S.D. (°C)	0.37	0.37	0.37	0.36	0.32	0.33	0.32	0.34

OVERALL AVERAGE = - 0.10°C

* SIGNIFICANTLY DIFFERENT FROM ZERO AT THE 95% PROBABILITY LEVEL